Ocean Worlds Lander Imager

Completed Technology Project (2016 - 2018)

Project Introduction

The objective of the work proposed here is to develop crucial components and reduce the technical risk of a comprehensive science and engineering imaging system for a Europa lander. Our instrument, the Ocean Worlds Lander Imager (OWL-I, pronounced "owl eye"), is based on existing flight heritage Mars rover cameras currently in operation on the surface of Mars and the JunoCam imager currently in operation around Jupiter. OWL-I will address the following objectives as part of an Ocean Worlds lander mission: Visible/NIR Stereo Panorama Investigation: Understand the local context of the landing site at lander scales, characterize the physical nature of the surface, and search for compositional variation. UV-stimulated Fluorescence Imaging Investigation: Search for compositional variation, including biomarkers, in ice near the lander, particularly organics and ocean-derived salts, using a UV fluorescence spotlight. Icy World Surface Properties Characterization: Characterize the physical nature of the surface by searching for evidence of ice resurfacing and sublimation processes with the aid of polarizing filters and a non-contact infrared (IR) thermometer. Assess the local Habitability of the landing site and understand its relation to regional and global processes. The technology development and risk reductions we propose are specific to the development of a flight imaging investigation that would meet the science objectives for an Ocean Worlds mission, with emphasis on the radiation environment and Planetary Protection constraints for Europa. The development tasks are listed below. Rad-Hard Optics Design Task: Upgrade existing Mars camera lens flight designs by incorporating radiation hardened (rad-hard) glass and develop a rad-hard lens design suitable for a Europa lander mission. Radiation Test Task: Conduct radiation tests on existing flight image detectors, lens elements, and optical filters for radiation hardness and characterize any accompanying changes after irradiation. DHMR Task: Conduct DHMR (Dry Heat Microbial Reduction) testing on flight heritage landed camera subassemblies. UV Spotlight Task: Develop a UV spotlight for a fluorescence imaging capability. The UV spotlight will be co-boresighted with a camera and will focus a beam of UV light onto a surface being imaged in low ambient light. We will test spotlight configurations and efficacy for a range of incidence angles and distances, on both lab-prepped and natural ice. Polarizer/Filter Task: Procure and test optical polarizing filters and determine the effectiveness of various polarization types (vertical, horizontal, and circular) when imaging varying grain sizes and surface textures, using lab-prepared and natural ice samples under different illumination conditions. Evaluate the suitability of existing optical/NIR filter bandpass filters for Europa. IR Radiometer Task: Procure and test IR thermopiles, to be co-boresighted with the camera system. We will compare the performance of several devices and include the best-performing device in our flight design. Cold Temperature Performance Task: Assess the performance of existing flight camera hardware components at these colder temperatures and update the OWL-I design as necessary. Images returned from the surface of an Ocean World such as Europa, Enceladus, or Titan will greatly improve our understanding of the ability of that surface environment

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Organizational Responsibility

Responsible Mission Directorate:

Science Mission Directorate (SMD)

Responsible Program:

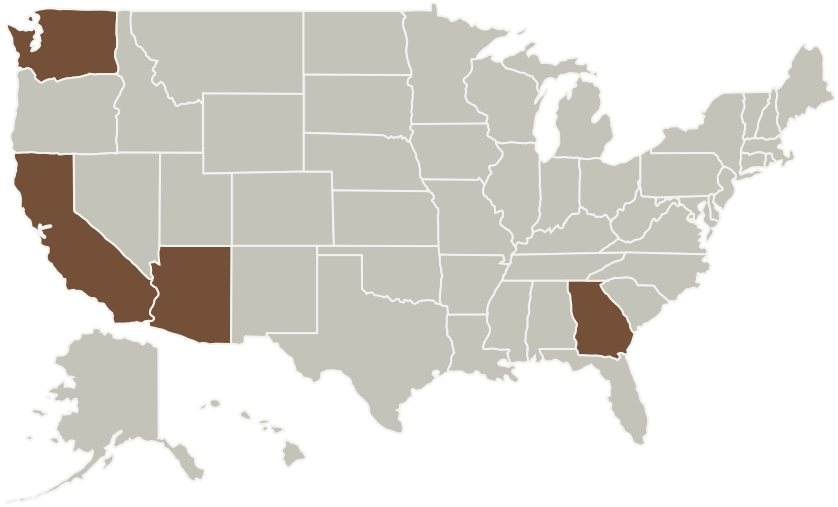
Concepts for Ocean Worlds Life Detection Technology

(including the materials exposed at the surface or in the subsurface accessible to sample extraction tools) to have preserved evidence of biosignatures and to gauge the habitability of that world's liquid reservoirs, including its subsurface ocean

Anticipated Benefits

Development of a Lander Imaging System for use on NASA Planetary Missions to explore Ocean Worlds in the outer solar system.

Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
California Institute of Technology(CalTech)	Supporting Organization	Academia	Pasadena, California

Primary U.S. Work Locations	
Arizona	California
Georgia	Washington

Project Management

Program Director:

Carolyn R Mercer

Program Manager:

Carolyn R Mercer

Principal Investigator:

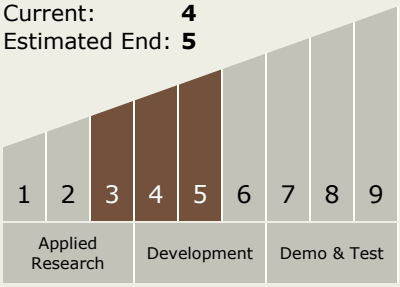
Justin N Maki

Co-Investigators:

James F Bell
Ronald S Sletten
David A Paige
Karen R Piggee
Rohit Bhartia
Michael Caplinger
Britney Schmidt
Kenneth S Edgett

Technology Maturity (TRL)

Start: **3**
Current: **4**
Estimated End: **5**



Technology Areas

Primary:

- TX08 Sensors and Instruments

Continued on following page.

Technology Areas *(cont.)*

- TX08.1 Remote Sensing Instruments/Sensors
  - TX08.1.1 Detectors and Focal Planes

Target Destination

Others Inside the Solar System